CLAIMS

Therefore, having thus described the invention, at least the following is claimed:

1. A device, comprising:

an optical interconnect layer including:

a first cladding layer;

a second cladding layer;

at least one waveguide having a waveguide core; and

an air-gap cladding layer engaging a portion of waveguide core, wherein the first cladding layer and the second cladding layer engage the waveguide.

2. The device of claim 1, wherein the device is chosen from a backplane, a printed wiring board, and a multi-chip module.

3. The device of claim 1, further comprising, at least one coupler element disposed adjacent to the waveguide core.

4. The device of claim 1, further comprising:

a first sacrificial layer that can be removed to form the air-gap cladding layer.

5. The device of claim 4, wherein the first sacrificial layer is chosen from polynorborenes, polyoxymethylene, polycarbonates, polyethers, and polyesters.

6. An optical interconnect layer, comprising:

a first cladding layer;

a second cladding layer;

at least one optical dielectric waveguide having a waveguide core; and

an air-gap cladding layer engaging a portion of waveguide core,

wherein the first cladding layer and the second cladding layer engage the waveguide.

7. The optical interconnect layer of claim 6, further comprising a substrate made of a dielectric material.

8. The optical interconnect layer of claim 6, wherein the first cladding layer is chosen from polyimides, polynorborenes, epoxides, polyarylenes, ethers, and parylenes.

9. The optical interconnect layer of claim 6, wherein the second cladding layer is chosen from polyimides, polynorborenes, epoxides, polyarylenes, ethers, and parylenes.

10. The optical interconnect layer of claim 6, wherein the air-gap cladding layer has a height from about 1 to about 100 micrometers.

11. A method for monolithically fabricating an optical interconnect layer comprising:

(a) disposing at least one waveguide core on a portion of a first cladding layer;

(b) disposing a sacrificial layer onto at least one portion of the first cladding layer and a portion of the waveguide core;

(c) disposing an second cladding layer onto the first cladding layer and the sacrificial layer; and

(d) removing the sacrificial layer to define an air-gap cladding layer within the first cladding layer and the second cladding layer, and wherein the air-gap cladding engages a portion of the waveguide core.

12. The method of claim 11, further including:

forming a volume grating layer adjacent to the waveguide core after (a) and before (b).

13. The method of claim 12, further including:

forming at least one volume grating coupler element.

14. The method of claim 11, further including:

integrating the optical interconnect layer into a device chosen from a backplane, a printed wiring board, and a multi-chip module.

15. A method for fabricating a device having an optical interconnect layer comprising:

disposing at least one waveguide core on a portion of a first cladding layer;

forming at least one volume grating coupler element adjacent the waveguide core;

disposing a sacrificial layer onto at least one portion of the first cladding layer and a portion of the waveguide core;

disposing a second cladding layer onto the first cladding layer and the sacrificial layer;

removing the sacrificial layer to define an air-gap cladding layer within the first cladding layer and the second cladding layer, and wherein the air-gap cladding engages a portion of the waveguide core; and

attaching the optical interconnect layer to a device chosen from a backplane, printed wiring board, and a multi-chip module.

16. The method of claim 15, wherein the sacrificial layer is chosen from polynorborenes, polyoxymethylene, polycarbonates, polyethers, and polyesters.

17. The method of claim 15, wherein the waveguide core includes a transparent dielectric material.

18. The method of claim 15, wherein the first cladding layer is chosen from polyimides, polynorborenes, epoxides, polyarylenes, ethers, and parylenes.

19. The method of claim 15, wherein the second cladding layer is chosen from polyimides, polynorborenes, epoxides, polyarylenes, ethers, and parylenes.